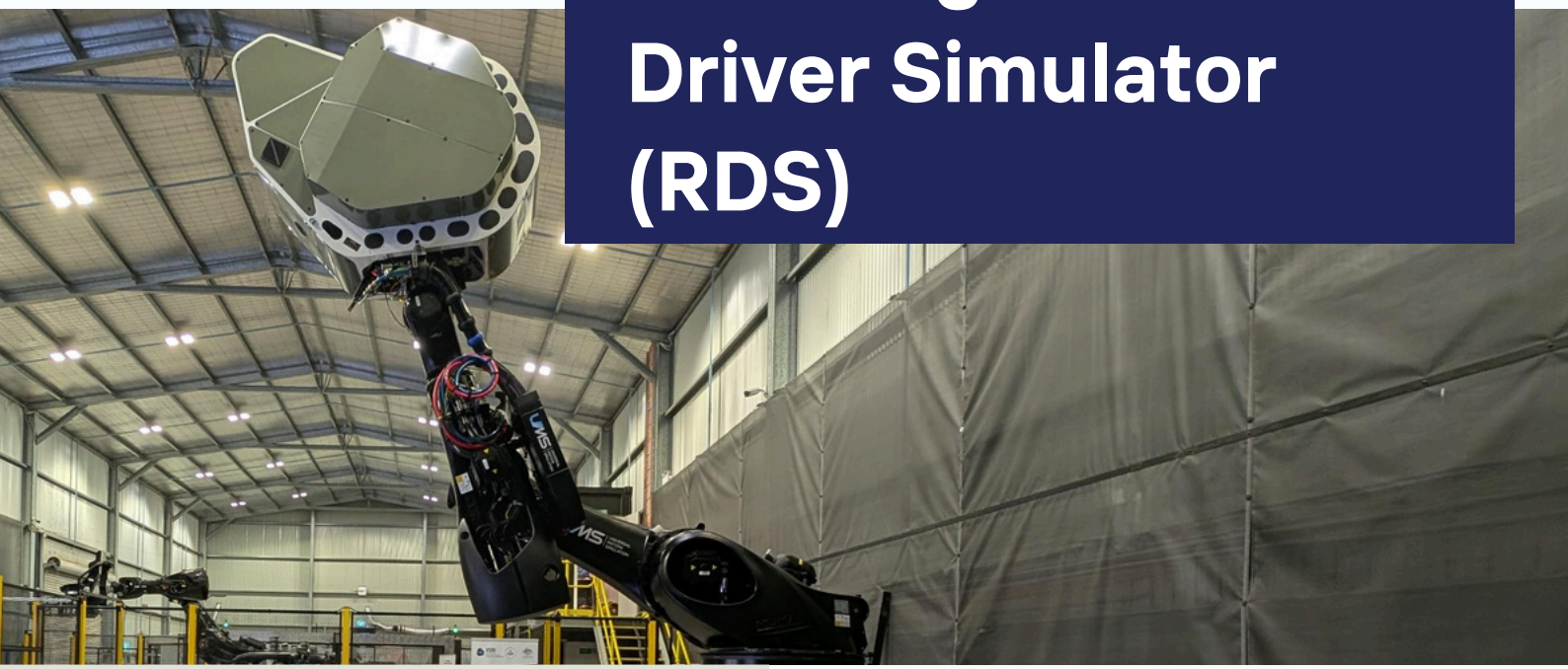
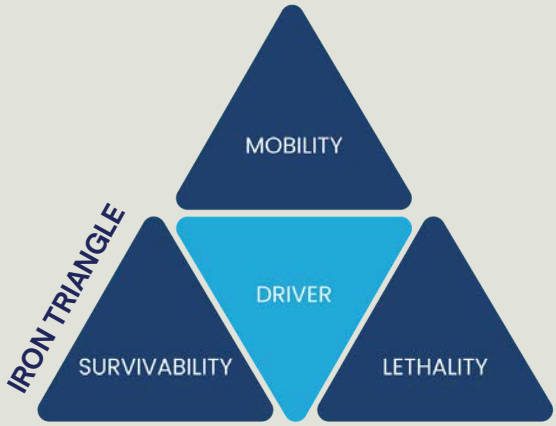
UNIVERSAL MOTION SIMULATION

Reconfigurable Driver Simulator (RDS)



The Universal Motion Simulation Reconfigurable Driver Simulator (RDS) is a next-generation driver training solution combining a TÜV-certified 6-DOF robotic arm motion platform with rapidly interchangeable, vehicle-specific cabins.

RDS delivers unmatched fidelity, immersion, and safety while reducing cost and footprint.



Key Benefits

- Multi-vehicle training in one footprint
- Immersive realism — visual, audio, haptics
- Safety-first design with interlocks, fire safety, and airflow control
- Scalable, future-proof system where new vehicles are added via cabins
- Proven performance in Army deployments

Core Features

- Motion platform: 6DOF, extreme ranges, rollover simulation capability
- Rapid reconfiguration: cabin swaps in minutes/seconds
- Visual immersion: Ultra Reality™, periscopes, CGI rendering, IR/NVG
- Vehicle physics fidelity: OEM data-based models, 1cm terrain resolution
- Training ecosystem: IOS, After Action Review, scenarios, LMS/TMS integration
- Interoperability: HLA/DIS standards compliant

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Scan for more information

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Overview

The Universal Motion Simulation (UMS) Reconfigurable Driver Simulator (RDS) is a highly dynamic motion platform featuring a **6 Degree of Freedom (DOF) robotic motion platform**, rapid coupling mechanism, rapidly interchangeable cabins, haptic-enabled controls, immersive simulation environments, and advanced motion control, including high fidelity vehicle physics.

The robotic motion platform, rapid coupling mechanism, and Instructor Operating Station (IOS) form the core of the RDS and are common to all vehicle configurations.

The Cabin subsystem is vehicle-specific, providing a **fully immersive experience** with realistic controls and virtual environment through the innovative use of displays.

Cabin exchange can be achieved in minutes, automatically reconfiguring the driver environment, vehicle visualisation and physics, training terrains and training scenarios.

The reconfigurable nature of the system minimises space requirements, maximises system utilization, and **significantly reduces operational and capital costs**.

Reconfigurable Driver Simulator (RDS)

RDS Abrams Vehicle Variant

Range of Motion

The 6DOF robot motion platform is European designed and manufactured, **TÜV (PTU) and EN 13814 certified** for carrying passengers, and CSEI compliant.

The six joints of the robot arm enable the simulator to provide **superior motion cues** for vehicle acceleration in all axes. The very large range of motion and independence between robot joints create a unique capability to provide large heave, surge and sway coupled with large pitch and roll rotations.

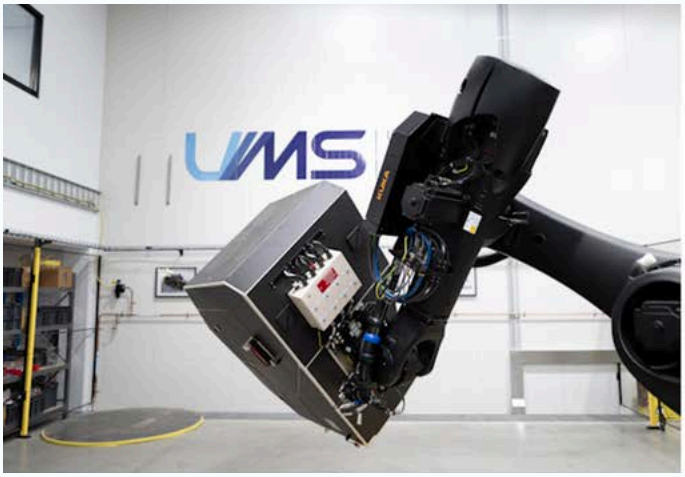
This combination can deliver motion cues that are not possible using a traditional hexapod motion base. Extreme pitch and roll angles can also support advanced driving scenarios including a complete rollover.

Basic Ranges of Motion

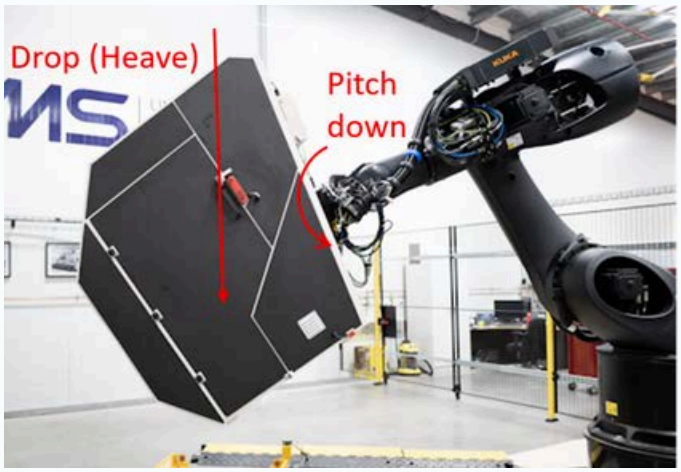
Payload Weight	600 kg
Platform Height	1.0 m - 3.9 m
Heave	±1.1 m
Surge/Sway	± 0.9 m / ±2.0 m
Pitch	±58°
Roll	±120°
Yaw	±75°

Range of Motion continued

Large pitch rotation plus heave with RDS



Roll rotation, can be combined with other motions



Large drop and heave when cresting

Rapid Configuration

All vehicle-specific software and configuration is stored on the vehicle specific driver cabin and loaded automatically when each specific cabin (vehicle) is connected to the motion platform – **change the cabin and the entire system, physical and virtual environments, changes with it.**

The footprint of a single RDS installation can support multiple vehicle types, making the system very **space and cost-effective** as the physical introduction of a new vehicle variant is limited to the addition of a new cabin with no additional requirement for motion hardware, space etc.

A **pneumatically operated robot tool changer** has been incorporated to enable a cabin to be changed. The cabin-to-robot rapid coupling is fail-safe interlocked; the cabin remains securely locked to the robot motion platform in the unlikely event of air supply failure.

A cabin can be **manually swapped in less than 5 minutes.** Alternatively, the robot itself can pick and load cabins in seconds from an integrated rack or carousel.

RDS Rapid Cabin Changeover System

Landing position (left) and operating orientation (right)

Automatic Configuration

The RDS automatically reconfigures itself for each different vehicle cabin attached. All vehicle-specific functionality, configuration and databases are stored on the cabin itself. When a cabin is connected to the system, its type is detected and the RDS automatically configures to the specific vehicle required.

Vehicle Physics – a dedicated physics model is created for each vehicle.

Motion Tuning – each vehicle behaves differently, so the motion cueing algorithm (the translation between virtual motion and robot movement) is customised for each vehicle.

Vehicle Logic – the software logic that replicates real vehicle behaviour.

Vehicle Graphics – displayed to Instructor at the IOS and through the driver's view-ports.

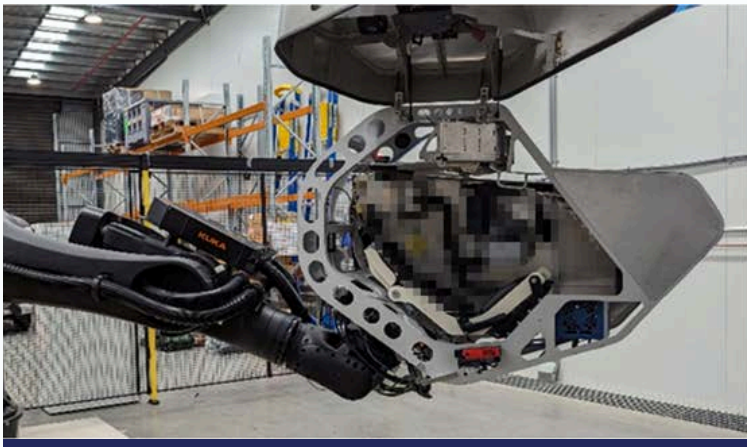
Robot safety limits - applied specifically for each cabin geometry using the proven KUKA Safe Operation module.

Training Scenarios – each vehicle has a set of terrains and scenarios appropriate to its purpose and performance, these are selectable based on connected cabin type.

IOS vehicle representation – the instructor's view of vehicle parameters is unique for each vehicle, including controls, interface panels.

Injected Faults – a set of vehicle faults available for instructor to trigger at their discretion.

Cabin ingress/egress flexibility



The overall operating envelope of the RDS can be tailored to maximise the space available whilst minimising any compromise in simulation fidelity.

The flexibility offered by the robot also enables safe and efficient ingress/egress for trainee.

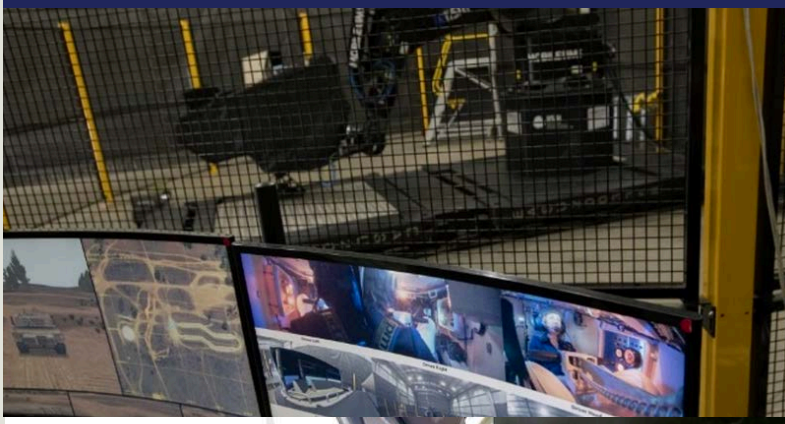
Motion & Sensation Realism

Advanced motion-cueing algorithms **replicate the sensation of the vehicle motion**, as experienced by the operator's vestibular system and proprioceptors. Based upon concepts and mathematical models pioneered by NASA, the algorithm considers the function of human vestibular system to create simulator motion that mimics sensations generated in the actual vehicle.

The tight, low latency synchronisation of the high-fidelity motion with the computer-generated imagery **ensures that simulator sickness symptoms are mitigated.**

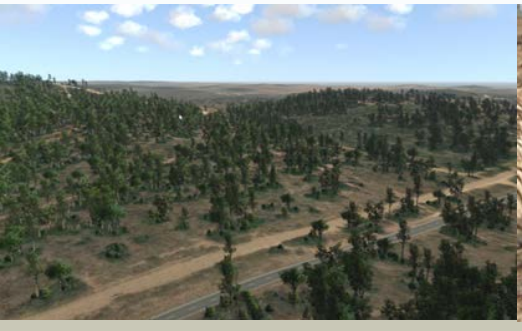
The unique capabilities of the motion system are ideally suited to off road ground vehicle simulation where large, high acceleration heave motions coupled with large pitch and roll rotations are experienced.

The overall experiential fidelity of the simulation system **far exceeds that of traditional motion simulator systems.**



Terrains

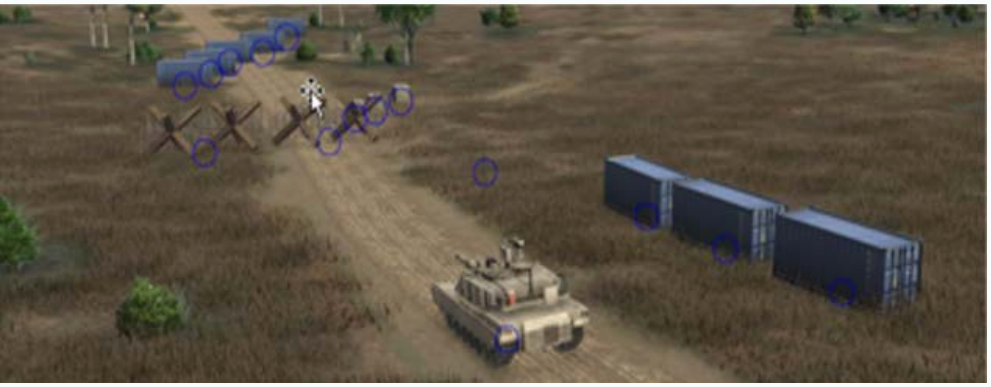
The RDS software is built upon the industry standard MAK Technologies software suite and, as such, has inbuilt support for most common terrain data formats. Nonstandard formats can be accommodated using suitable plugin and ustom-designed terrain features tailored to specific training objectives.



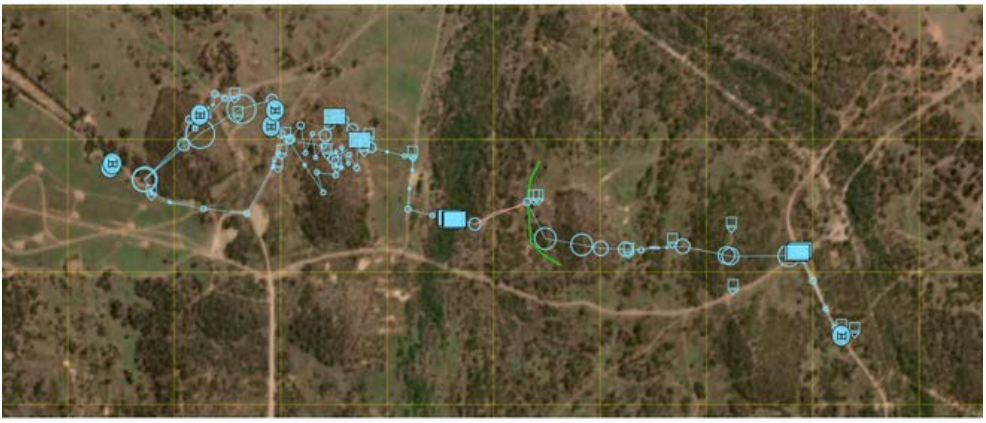
Training Scenarios & Task Evaluation

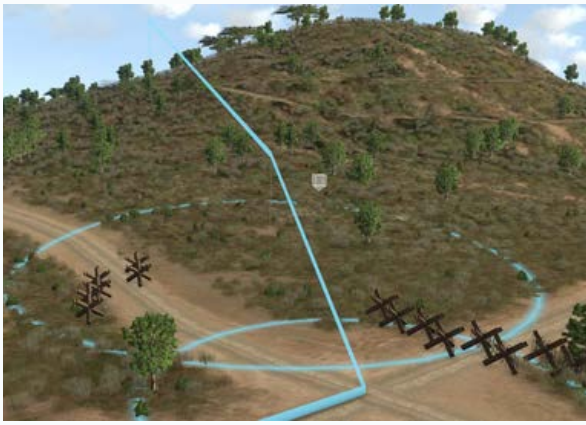
Scenario Development services are provided by UMS for each simulator delivered. Scenarios are developed by UMS's experienced scenario development team in conjunction with the end-user's subject matter experts.

The system supports predefined training scenarios on any supported terrain type. The **scenario library can be extended and expanded as needed** with new tasks, vehicles, obstacles, and terrains. The system supports the **real-time introduction of fault conditions** while monitoring trainee response.



Obstacles, Fences, Barriers





Training scenario with objectives marked for Instructor

The UMS Scenario Editor Application allows:

- Creation of rich Scenarios with vehicle and training SMEs
- Creation of custom training routes and evaluation tasks

Highly Realistic Driving Experience

RDS features highly accurate vehicle physics models allowing faithful replication of the vehicle motion. The physics models are developed using OEM data and data collected from instrumented vehicles and are subjectively fine-tuned with feedback provided by experienced drivers.

When required, very accurate terrain models are used. The level of detail can be as high as 1cm resolution of ground-features.

Haptic Controls

Haptic feedback controls are included as standard on the RDS. A dynamic force feedback steering loader provides realistic simulation of the vehicle's steering system. Detailed steering force models are integrated with the vehicle dynamics and surface terrain to provide accurate feedback of steering forces to the operator. Haptic feedback on the vehicle brake pedal can provide the correct braking feel to the driver.

Instructor Operating System (IOS)

The IOS allows the instructor to execute training scenarios, monitor the trainee's performance, initiate events within the training scenario in real-time, such as vehicle faults and environmental changes, while communicating with the trainee.

Vehicle telemetry and video are recorded allowing **manual and automated assessment, and after-action-reviews**.

The IOS provides a physical interface to the Training Management System (TMS) to allow update of the availability and utilisation data. Plugins are available to support integration with external TMS.

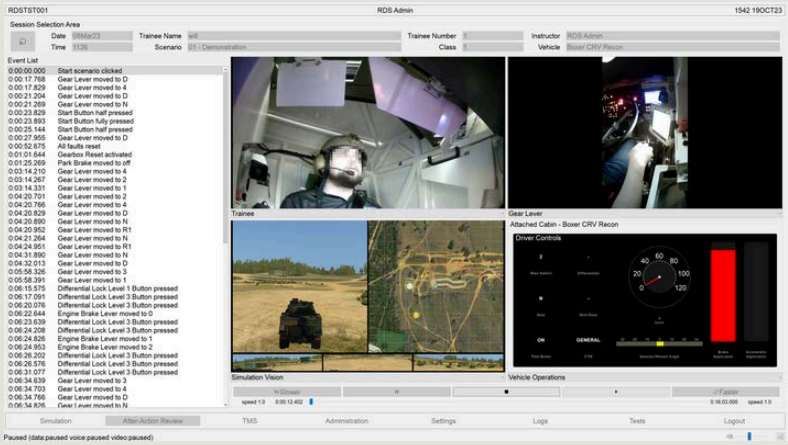
The instructor can control the robot motion platform through the IOS.

IOS Typical Layout

Trainee Management and TMS / LMS Integration

RDS can integrate with an external Trainee Management System (TMS) where required. This can be customer built TMS or commercially available system such as Moodle or Arlo.

IOS provides a Web Browser interface that can be used to view and control the LMS / TMS. Linking with an external LMS/TMS aids user management and record keeping across other simulators and training tools. UMS can provide services for linking to an established customer LMS/TMS or can provide the LMS/TMS with the simulator.



After Action Review Screen

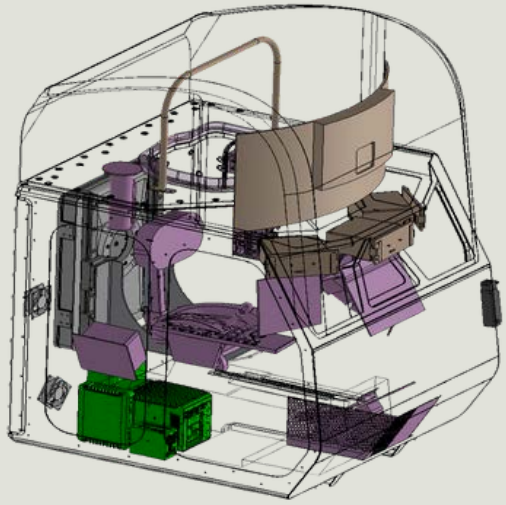
Cabin Replication

The RDS can simulate vehicles operating with hatch closed or open. With hatch closed operation, the view periscopes are faithfully simulated using replica periscope optics and high-resolution monitors.

Replicated Periscope Vision

When operating hatch open, the required wide field-of-view is achieved using the Ultra Reality™ virtual monitor, thereby obviating the need for a dome, goggles or headset.

The fully instrumented cabins are equipped with actual vehicle parts and highly accurate replica components using light-weight materials to represent vehicle controls, instrument panels and visualisation hardware. Where appropriate haptics and audio are applied.

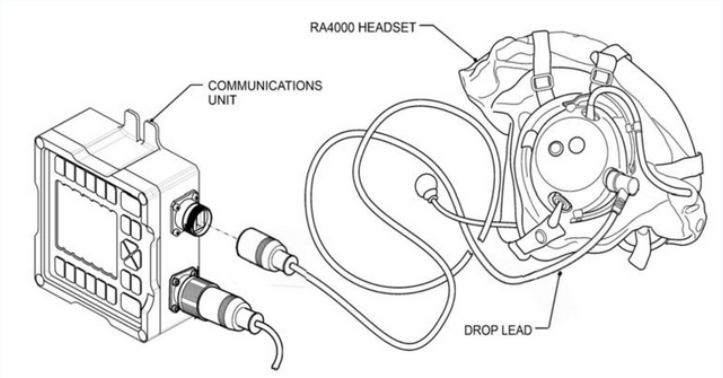


RDS is designed to accommodate a trainee (with equipment) up to 120 kg and between 5th to 95th percentile body dimensions.

Integration & Interoperability

The RDS has a modular software architecture and uses open standards. It is fully compliant with HLA 1.3, HLA 1516 (SISO DLC version of HLA 1516-2000), and HLA Evolved (HLA 1516-2010). It also supports the Distributed Interactive Simulation (DIS) protocol, versions 4, 5, 6, and 7.

The RDS has built-in support for the HLA RPR-FOM and can support other FOMs. It is compatible with most modern simulation software packages and currently employs the MAK suite of VR-Engage, VR-Forces and VR-Link. RDS can be networked with other RDS and, also, third party simulators using open standards.



Cabin Communication Headset and Control Unit

Safety

Safety features include:
A full set of safety interlocks including multiple emergency stop buttons and detection of unbuckling cabin seatbelt or opening of a perimeter gate.

- Independent certification of the Kuka motion platform for passenger carry by TÜV
- Certified robot SafeOperation module ensures the cabin will never impact ground or surroundings
- Safety-Related Controls are implemented in a dedicated PLC, compliant to EN ISO 13849-1 Performance Level (PL) PLd
- Boundary controls developed in accordance with "AS 4024 Safety of Machinery"
- Robot motion platform compliant with EN 13814:2004/AS 3533.1 Amusement Ride safety standard
- Cabin operates on Extra-Low-Voltage 24 VDC, significantly reducing risk of injury or fire

Security

Security is assured by:

- Hardened Operating Environments following guidelines from Australian Cyber Security Centre.
- Internally segregated and protected networks:
  -RDS-Core
  -Motion-Control
  -External interfaces
- Multiple levels of user-privileges are supported:
  -Operator
  -Maintainer
  -Administrator

Current RDS Contracts


Boxer CRV


M1A2 SEPv3 MBT


M1150 ABV

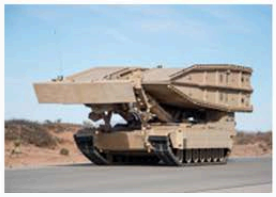

M88A2 ARV

Future RDS Developments


K9 Thunder SPH


K10 AARV


AS21 Redback IFV


M1074/M1110 JAB

Technical Specifications

Motion Platform

Payload Weight	600 kg
Platform Height	1.0 m - 3.9 m
Heave	±1.1 m
Surge/ Sway	±0.9 m / ±2.0 m
Pitch	±58°
Roll	±120°
Yaw	±75°

Dimensions & Mass

Enclosure	7.7m x 8.6m x 6m (standard) / 6.5m x 6.5m x 5m (compact)*
Platform mass	4,200kg (robot + base)
Cabin mass	Nominally 460kg, including trainee

Power & Air

Robot	1x 415 VAC, 32A (380V-480V three-phase)
Aux	1x 240 VAC, 20A (240V ±10%, 49-61 Hz), or equivalent
IOS	1x 240 VAC, 15A (240V ±10%, 49-61 Hz), or equivalent
Air (system inc.)	Cabin-to-robot rapid coupling device: air-pressure supply of 100 psi (used to release the cabin-to-robot rapid coupling), nominal consumption only.

Environment

Operating temperature range of +15°C to +35°C and relative humidity of 50% to 70%.

Cabins

Vehicle-specific, OEM/replica controls, haptics, periscopes, Ultra Reality™ monitors, hatch-open or closed operation.

Visual & Audio Systems

- High-res CGI rendering with low latency
- Weather/time-of-day/IR/NVG effects
- Directional stereo with Doppler/attenuation effects

*Minimum ceiling height varies by vehicle, this figure is based on upright driving position of Boxer CRV).

Technical Specifications cont.

Vehicle Systems Modelling

Engine, transmission, hydraulics, electricals, fuel, diagnostics with simulated faults and degraded modes.

Training Tools

- IOS: 3 monitors, robot control, real-time fault/event injection
- AAR: replay, logs, telemetry, comms review
- Scenario Editor: terrain/obstacle/task creation

Interoperability

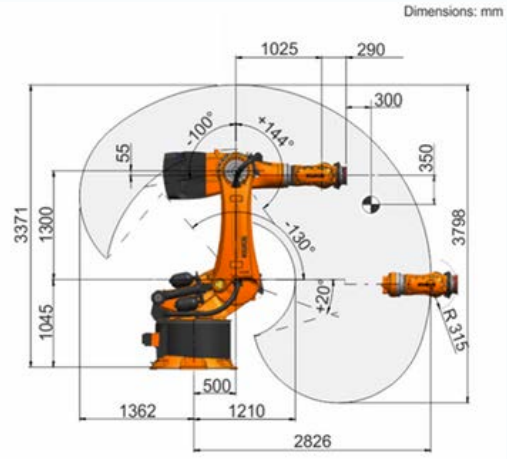
HLA 1.3/1516/Evolved, DIS v4–7, compatible with MAK suite (VR-Engage, VR-Forces, VR-Link).

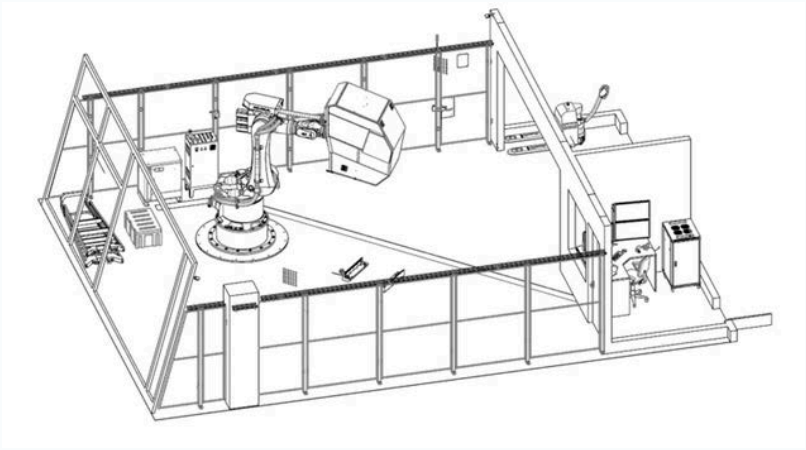
Safety

Seatbelts, access/door interlocks, fire suppression, airflow monitoring.

Transportability

Containerised RDS option. Cabins stored in cradles or robotic racks.





Typical Enclosure

Maintenance & Lifecycle

The RDS robot motion platform is a proven industrial robot arm designed for high utilisation and payload that is derated for passenger use.

The robot life is greater than 15 years usage with an operational utilisation of 2,000 hours per year. Given the typical utilisation in this application, many life-rated components may never be replaced.

Maintenance of the robot motion platform is performed by the vendor, KUKA. The RDS system is otherwise supported and maintained by authorised partners of UMS in the country of use. The SLA is tailored to the user's requirements and will typically include hotline support during working hours and next day on-site support.